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Breaking of the selection rules for optical transitions in the dielectric PrFe3(BO3)4 crystal by a praseodymium-iron exchange interaction

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Abstract

We report on the emergence of new lines in the optical spectrum of the PrFe3(BO3)4 single crystal at the magnetic ordering temperature. The transitions between singlet crystal-field sublevels of Pr3+ ion with the same transformational properties, strictly forbidden for the trigonal D3 point symmetry of this ion in PrFe3(BO3)4, appear below the Néel temperature and grow in intensity as a square of the order parameter. We show that the phenomenon originates from the mixing of wave functions of different Pr3+ sublevels by the Pr-Fe exchange interaction.

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